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RICE CURLS—Production and Cost

Otto R. Vasak

Western Regional Research Laboratory
Albany, California

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RICE CURLS--Production and Cost 1/

As a part of research in the Bureau of Agricultural and Industrial Chemistry on utilization of rice, workers in the Western Regional Research Laboratory have experimented with a snack food made by the simple process of grinding rice, mixing it with hot water, extruding the paste in the form of curls, and frying the curls in deep fat.

This product, called Rice Curls, offers a commercial use for broken rice grains, which have a limited market as food rice. Estimates indicate that about 500,000 tons of broken grains are produced annually. Whole rice of course can be used also.

A description of the product and its laboratory preparation is reported in AIC-258, "Rice Curls--A New Food Product from Rice," by R. L. Roberts, E. B. Kester, and D. F. Houston of this Laboratory. Response to this report and to samples of product prepared in this Laboratory has revealed a need for additional information on a commercial process for the production of Rice Curls and the probable costs. Cost studies are made in this Laboratory as an aid in evaluation of projects on new products and processes. The information below offers a preliminary cost estimate for those who may wish to consider production of Rice Curls.

Steps have been taken to obtain a public-service patent on Rice Curls. Permission for use of the process can be obtained without royalty fees on application to the Chief of the Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture, Washington, D. C.

Process Description

In a commercial operation, rice would be ground in one of several suitable mills and then mixed quickly with an equal weight of hot water to form a stiff paste or dough. The water must be at 190°F. or higher for satisfactory results. The paste should not be overworked.

The paste would be placed in a cylinder of a vertical extrusion press and forced through 3/16" holes located in the bottom plate. Automatic knives then would cut the extruded dough into convenient lengths, about three inches. The dough segments would fall into a frying vat located directly below the extruder and cook in vegetable oil at 390°-420°F. for approximately three minutes. At the end of this time evolution of steam practically ceases and the curls are toasted golden brown.

Several vegetable oils can be used for frying Rice Curls. Refined oils expressed or extracted from peanuts, sesame-seed, corn, soybeans, and cottonseed are satisfactory. Hydrogenated shortenings in some localities are preferred for deep-fat frying, because the products are inclined to appear less greasy.

1/ Report of a study made under the Research and Marketing Act of 1946.

Equipment and Investment

Commercial machinery needed to make rice curls consists of standard pieces of relatively simple equipment, comparable to that used in the manufacture of corn chips, corn curls, and potato chips. The dough preparation step would require a bin for rice storage, bucket conveyor, hoppers, grinder (of coffee or buhrstone type), dough mixers, hot water heater, and miscellaneous equipment such as work tables, carts, and hand trucks.

A single or double cylinder unit is needed for the extrusion operation; equipment for the frying step would consist of an automatic cooking vat and an oil storage tank. The packaging operation can be handled with rubber conveyor belts and standard packaging units.

The probable installed cost of equipment needed for the manufacture of rice curls in variable quantities is given in the following table:

Manufacturing step	Estimated cost of installed equipment for variable-size rice curl operations		
	50 lbs. per hr.	150 lbs. per hr.	300 lbs. per hr.
Dough preparation	$2,500	$4,400	$7,200
Extrusion	2,100	2,100	2,700
Frying	3,300	4,900	6,200
Packaging	1,300	1,300	1,300
Total installed equipment cost	$9,200	$12,700	$17,400

These approximate costs would constitute the major investment required of prospective rice curl manufacturers already having surplus building space available for the equipment installation.

An additional investment for building and land will be needed if new construction is necessary to furnish floor area. In estimating the building investments, as listed below, it is assumed that construction costs are about $6 per square foot.

Additional investment	Approximate cost of land and building for variable-size rice curl operations		
	50 lbs. per hr.	150 lbs. per hr.	300 lbs. per hr.
Building	$19,000	$27,000	$34,000
Land	5,000	5,000	5,000
Total building and land investment	$24,000	$32,000	$39,000

The above approximations are intended only as a guide, since building costs vary considerably with locality and type of construction.

Raw Material Costs

The processing costs that will be incurred in the production of rice curls, corn chips, or potato chips are closely related for a given size of operation, because of similar equipment used, comparable labor requirements, etc. The total production cost, however, would vary because of the different raw material costs. These raw material costs depend upon the prices of the grains and potatoes, and also upon the solids content, oil content, and moisture content of the finished product.

Rice Curl raw material costs per pound of finished product are as follows:

Raw materials	Rice Curls[1/]
Solids	5.4¢
Oil	3.4
Raw material cost per pound product	8.8¢

1/ The average moisture content of dry rice is approximately 15 percent. The composition of finished rice curls is assumed to be as follows: 77 percent rice solids; 20 percent oil; and 3 percent water. In establishing the cost data, $6.00 a hundred-weight for second heads was used, which was the quotation at the time this study was made. During the past year the price range has been $4.00 to $8.00 per hundred-weight, in San Francisco. The cost of refined cottonseed oil was about 17 cents per pound.

The oil content of rice curls decreases as the amount of water in the dough is reduced. It is therefore desirable to use as little water as possible, because an overly greasy food product lacks sales appeal. Moreover, materials costs become less, because rice solids are less expensive than cooking oils.

Production Costs

Preliminary estimates show that the production and packaging costs incurred in the manuracture of Rice Curls would be approximately as given below:

Plant capacity per hour	Estimated production and packaging costs per pound
50 lbs.	38.5 cents
150 "	25.0 "
300 "	21.5 "

The figures above are based upon the assumption that Rice Curls would be manufactured in self-contained processing plants operating 250 eight-hour shifts per year. It is also assumed that the curls are packaged in 4-ounce lithographed duplex wax-paper bags. Since product losses during processing and packaging will be small and will vary from plant to plant, no allowance for Rice Curl loss is included in this estimate. Each prospective operator can estimate product loss for his own situation and adjust costs accordingly.

If, however, the Rice Curl process is installed as a sideline in a potato-chip factory or other specialty food product plant, savings would result from the use of existing facilities such as storage space, auxiliary equipment and public utilities. The net effect on processing costs would be minor, however, as only 7 percent of the estimated production costs of the 50-pound-per-hour and 3.5 percent of the 300-pound-per-hour operation represent charges on new building. The main advantage in use of existing facilities is an immediate saving in capital investment. An already established management structure, sales force, and delivery service would permit further economies. A portion of the expense for maintaining common management, building, and facilities would, of course, be properly chargeable to the new product item.

The curves in Figures 1 and 2 show total production and packaging costs as a function of plant capacity. In Figure 1 separate curves show the relationship between the major cost components (factory burden, labor, and materials); the curves in Figure 2 show the relative costs of the various processing steps. According to data in Figures 1 and 2, production and packaging costs will not be decreased appreciably with increases in plant capacity beyond the 300-pound-per-hour figure.

Summary

From the foregoing discussion and data it can be concluded that a plant with a capacity of not less than 150-300 pounds of Rice Curls per hour is desirable for commercial application of this process. As production capacity is increased, the cost of materials becomes the important factor in the total production and packaging cost. Factory burden and particularly labor costs are reduced considerably as size of operation is increased. In the 50-pound-per-hour operation, rice, cooking oil, and bags account for about 45 percent of the total production and packaging cost, while the same materials represent approximately 75 percent of the production and packaging cost for the 300-pound-per-hour operation.